



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Chi Yung Fu

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Examiner: Brusca, John S.

For: Non-Invasive Diagnostic and Monitoring Method

and Apparatus Based on Odor Detection

DECLARATION OF JYH-SHING ROGER JANG

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Jyh-Shing Roger Jang, hereby declare that:

I am a citizen of Taiwan and a resident of Taipei, Taiwan.

I hold a Ph.D. in Electrical Engineering and Computer Sciences from the University
of California at Berkeley with Prof. Lotfi Zadeh, the father of fuzzy logic, as my thesis
advisor.

Since 1995 I have worked as an Associate Professor at the Department of Computer
Science, National Taiwan University, Taiwan, and previously I worked as a software
engineer at The MathWorks Inc. at Natick, Massachusetts. My research areas include, but
are not limited to, neural networks and fuzzy logic, pattern recognition, speech recognition,

speech synthesis, and music information retrieval. I am an associate editor for the following professional publications - IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics) (since 2001), International Journal of Multiple Valued Logic (since 1998), and International Journal of Fuzzy Systems (since 1996). I have a total of 85 journal and conference publications in the research areas listed above with at least two-thirds of my publications in the area related to the present case.

I am a coinventor of U.S. Patent 5,664,066 to Sun et al.

I have reviewed the present patent application, the pending office action, and the prior art references cited therein.

Contrary to the Examiner's assertion, the combination of Ping '97 and Ping '96 does not show an artificial neural network that includes fuzzy filters, as claimed by Applicant. Neither Ping '97 nor Ping '96 show fuzzy filters at all, but are directed to a fuzzy clustering algorithm. The Examiner acknowledges that Ping '97 does not show fuzzy filters, and relies on Ping '96 for this feature. But Ping '97 and Ping '96 describe the same system; Ping '97 refers to Ping '96 for the details of the algorithm. Ping '97, at page 1033, col. 1, "Recognition algorithm" states: "Here, a non-supervised fuzzy clustering algorithm, which is discussed in detail elsewhere (Wang & Xie, 1996), is applied to the analysis of the sensor responses." Wang & Xie, 1996 is Ping '96 (see References, page 1036). Thus the term "fuzzy logic" in Ping '96 refers to the fuzzy clustering algorithm and not fuzzy filters. Although the term fuzzy is used in both situations, they are most definitely different.

The present invention uses fuzzy filters with a neural network, as recited generally in Claims 1 and 11, and more particularly in Claims 23 and 29, to simplify the neural

network structure, i.e. to choose the appropriate number of neurons in a layer, during processing (specification, page 41, 43). Neither Ping '97 nor Ping '96 shows this feature. Instead Ping '97 and Ping '96 show a fuzzy clustering algorithm.

The following summarizes the major differences between Wang's (Ping's) fuzzy logic approach and Applicant's fuzzy filter approach.

1. Structure is different: Applicant's fuzzy filter approach requires the inputs to be related in some manner, e.g. spatially/spectrally/temporally, such that each fuzzy filter can summarize/aggregate these related inputs (such as plasma data, which are spectrally related, or in this case of applicant's odor signature data, which are all related to the chemical species in the breath being sensed) into a single one for further processing of the cascaded neural networks. On the other hand, Wang's approach incorporates a fuzzy c-means algorithm (FCMA) for better classification of results and the inputs to Wang's system do not have to be related in any way. This is evident from section 3.1 of the Ping '96 paper, where the computer simulation example uses only 3 independent inputs which are not related in any way.

2. Goal is different: Applicant's fuzzy filter approach aims at data fusion/summarization/aggregation/extraction, such that a smaller set of condensed inputs (weighted inputs via fuzzy filters) can be sent to neural networks for better generalizations. On the other hand, Wang's approach is an integration of FCMA and neural networks for better classification design, without any concept of "fuzzy filter" or "input extraction/condensing/aggregation".

3. Learning rule is different: Applicant's fuzzy filter approach uses gradient-based optimization, while Wang's approach uses a modified Picard iteration designed for FCMA and the embedded Gaussian functions.

Sun U.S. Patent 5,664,066 (of which both Applicant and I are coinventors) shows a neural network with fuzzy filters, but the fuzzy filters are only associated with the input neurons and not with any hidden layers. There is no basis for combining Sun with Ping '97 or '96 because there is no indication of how it would affect the algorithm of Ping or that it would provide any benefit. In fact, Sun's fuzzy filters are suitable for any neural network structures as long as the learning rule is based on gradient descent. Therefore it is possible to combine fuzzy filters and Wang's approach to create another paradigm, on the condition that the learning rule of Wang's approach has to switch to a less efficient gradient descent. In my opinion, Wang's approach is only a minor improvement over the old architecture. Therefore there is no point to add fuzzy filters to it since (a) the learning rule has to be changed, (b) the performance of Wang's approach is questionable in the first place. Ping '96 and '97 are directed to a fuzzy logic algorithm which does not utilize fuzzy filters, so there would be no reason for one skilled in the art to add the fuzzy filters from Sun to the Ping system. Furthermore, Ping '96, page 1707, col. 2, section 2.1 "Network structure" states clearly that a "two-layer structure is adopted in this algorithm, as shown in figure 1." Thus there is no suggestion whatever that any additional layers could or should be used.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the

United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Nov. 13, 2005
Date:

Jyh-Shing Roger Jang
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